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CS 385: Applied Database Management Systems
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a. Compute B$^+$.
$B^+ = (B)$
$B \rightarrow D \qquad B^+ = (B, D)$
$D \rightarrow A \qquad B^+ = (A, B, D)$
$A \rightarrow BCD \qquad B^+ = (A, B, C, D)$
$BC \rightarrow DE \qquad B^+ = (A, B, C, D, E)$

b. Prove (using Armstrongs axioms) that AF is a superkey.
$(AF)^+ \rightarrow (A) \qquad (AF)^+ = (A) \qquad (Reflexitivity)$
$(AF)^+ \rightarrow (F) \qquad (AF)^+ = (A, F) \qquad (Reflexitivity)$
$A \rightarrow BCD \qquad (AF)^+ = (A, B, C, D, F) \qquad (FD1)$
$A \rightarrow BC \rightarrow DE \qquad (AF)^+ = (A, B, C, D, E, F) \qquad (Transitivity)$
R$\subseteq$ $(AF)^+$, AF is a superkey.

c. Compute a canonical cover for the above set of functional dependencies F; give each step of your derivation with an explanation.
Using the union rule $B \rightarrow D$ is extraneous.
F'=$\{A \rightarrow BCD, BC \rightarrow DE, D \rightarrow A\}$
C is extraneous in $BC \rightarrow DE$.
$(B)^+ = (A, B, C, D, E)$
F"=$\{A \rightarrow BCD, B \rightarrow DE, D \rightarrow A\}$
D is extraneous in $A \rightarrow BCD$.
$(A)^+ = (A, B, C, D, E)$
F"'= F_c=$\{A \rightarrow BC, B \rightarrow DE, D \rightarrow A\}$

d. Give a 3NF decomposition of r based on the canonical cover.
{(A,B,C), (B,D,E), (D,A), (A,F)}

e. Give a BCNF decomposition of r using the original set of functional dependencies.
{(A,B,C,D), (A,E,F)} $\Rightarrow$ {(BD), (ABC), (AEF)}

f. Can you get the same BCNF decomposition of r as above, using the canonical cover?
No you cannot.